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Published to advance the Science of cold-blooded vertebrates

A PECULIAR COLOR DISPLAY IN THE YELLOW GRUNT.

While at the Marine Biological Station of the Carnegie Institution at the Tortugas Islands in the Gulf of Mexico, I had many opportunities to observe the brilliant colors of the coral-reef fishes. These are seen at their best only when the fish are at liberty in their natural waters.

The yellow grunt, *Haemulon sciurus*, has the head and body broadly striped with chrome-yellow and lavender-blue. The anals and ventrals are yellow, the belly and throat white. The outside of the fish would seem to afford a sufficient display; but, as in other grunts, the interior of the mouth is brightly colored. In this species it is vermilion everywhere from the caudal margin of the breathing valves as far back as the first gill slit. The mouth is large and can be opened very wide. When so opened it appears as a conspicuous red patch.

One morning in July, 1905, I crushed a large black sea-urchin (*Diadema*) and threw it into the water. Two yellow grunts soon appeared and began to feed on it. When I first saw them they were about a foot apart and directly facing each other. Presently one of them opened its mouth very wide so as to display fully its red lining. He then swam toward the other. The second fish opened its mouth in the same way but did not move. The first kept on until the

jaws of the two touched. His mouth was a bit larger or wider open so that his jaws overlapped for an instant those of the other fish. They then separated.

During the whole of this manoeuvre the two fish faced each other. To each the vivid red mouth lining of the other must be visible. To the human observer it is startlingly conspicuous. He cannot escape the impression that the fish are making a display; he might be pardoned for saying that they are bluffing. This impression is strengthened by the wide gaping of the mouth, by the facing position and by the rather deliberate approach. It is as if each were expecting the other to flee at any moment.

Such displays of conspicuous color patches are not rare among inconspicuous insects. They are thought to have been developed through natural selection and to serve the purpose of startling an enemy (Schreckfarben). In conspicuously colored insects they are probably quite as common, but are overlooked because superimposed on an already conspicuous coloration. In the grunt, the red mouth patch displayed suddenly on a background of yellow and blue stripes is to man conspicuous and startling. If seen in an insect it would undoubtedly be classified as a "Schreckfarbe." How it affects the fish's natural enemies we can hardly know.

The color patch is revealed to its fullest extent when the mouth is opened wide in the presence of an enemy. It seems to be little exposed in the usual taking of food. I have never seen it then. But the food of the species consists of crustaceans and annelids, whose visual organs, so far as we know, are unaffected by any color display. Selection need then hardly deprive the *Haemulons* of their mouth patches in order to assure their food supply. Considered as a contrivance for bluffing enemies the mouth patch seems of doubtful advantage. It is to be expected that enemies, if affected by it, would soon become accustomed to it and be no longer startled.

In any case it helps them to see better the oral weapon with which they are threatened. It should be easier for them to meet the attack.

On the whole it seems wisest to regard the display as merely incidental to the opening of the mouth in attack and as quite devoid of biological meaning. In its effect on food it is neutral; in its effect on enemies the advantages and disadvantages seem to be pretty well balanced. The disadvantages may have rather the best of it. The analysis of the case may help to an understanding of similar displays in other forms. It suggests caution in interpreting them.

JACOB REIGHARD,
Ann Arbor, Michigan.

PIKE-FISHING INCIDENTS.

The following incidents occurred during my vacation this summer in the Adirondack Mountains:

On August 14th Dr. H—— and myself went out pike fishing on Stony Creek Pond No. 1, in Cor-eys. At the time the incident happened I was rowing the boat and the Doctor trolling, using a shiner for bait. A pike was struck and after some play the line came away minus bait, hook and an inch of the gut to which the hook had been attached. Another baited hook was put on and we continued around the pond. On coming a second time to the spot where the fish was lost there was another strike, and a pike a little under two pounds was safely landed in the boat.

At the first cut I made in dressing this fish out dropped a shiner with the Doctor's lost hook and inch of gut snood fastened to it. The gut had been sawed off by the pike's teeth.

A few days later while fishing in the same place the following occurred:

I was still fishing, using a live perch as bait. My first catch was a pike weighing in the vicinity of one and a half pounds. He had swallowed the perch, and,